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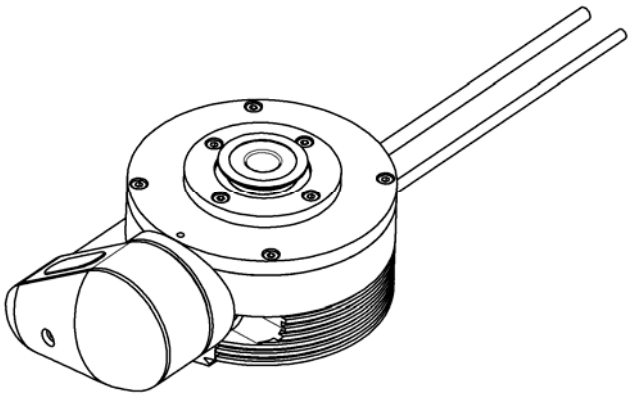

USER MANUAL

ELECTRICAL ROTARY UNIT

DAE-60

Mechanical Part

BA-100074
Starting from serial number 430044
English, Edition 02/2008

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1. Important information

1.1. Introduction

This User Manual describes the mechanical design, the technical data, the load limits, assembly, maintenance and spare parts of the electrical rotary units.

1.2. EU conformance (to EU Directive on Machine, Appendix II A)

Rules and standards complied with:
Machinery Directives 89/392/EEC, 91/368/EEC

Manufacturer:
Montech AG, Gewerbestrasse 12 CH–4552 Derendingen
Tel. +41 32 681 55 00, Fax +41 32 682 19 77

1.3. Product description and application

The electrical rotary units are electrically operated, position-controlled rotary units for executing regular, rotational forward and backward movements.
The electrical rotary units are equipped with a hollow shaft (internal diameter 15 mm).
Usually, the electrical rotary units are fixed to the housing.
The scope of delivery includes a EC Motor Controller (ECMR). This is preset at the factory and covers the whole operating range. Accordingly, subsequent adjustment is unnecessary.

The electrical rotary units are obtainable in the following versions:

Standard version: electrical rotary units – 60 (DAE-60)
The electrical rotary drives (DAE–60) in the standard version are assembled with vertical drive shafts.

Option: DAE-60 permanent magnet brake
Equipped with a permanent magnet brake, can be mounted in any installation position.

The load limits which were specified by the technical data must be complied with in all circumstances. Overloading can lead to faults and failure of the device.

1.4. Dangers

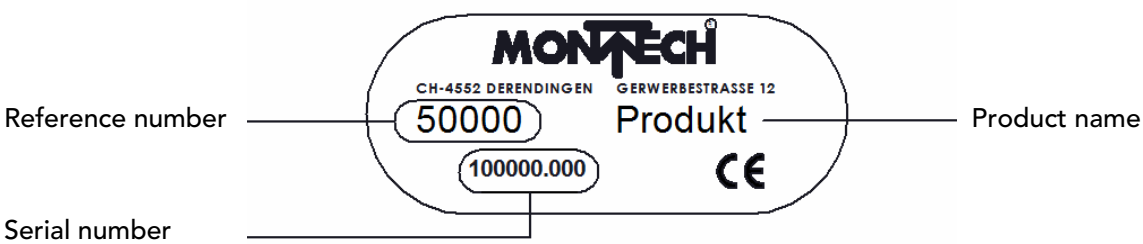
The use of DAE-60 in installations is only permissible when they are guarded by moveable, isolating protective devices according to EN 292-2, section 4.2.2.3. Failure to comply with this safety measure can result in injuries due to crushing and impact, particularly in machines which start up automatically.
It is essential to comply with the operating conditions and safety instructions described in the controller User Manual.
It is essential to comply with the stated load limits.

- During operation, the surfaces of motor and permanent magnet brake may reach up to 100°C. The parts must not be touched if the temperature has exceeded 40°C (measurement of surface temperature). .
- When working on the DAE-60, it must be ensured that the unit energy has been switched off and cannot be switched on by unauthorized persons.

1.5. Additional information

The aim of the present User Manual is to enable users to employ the DAE-60 correctly and safely. Should further information be required in relation to your particular application, please contact the manufacturer.
When reordering User Manuals, it is essential to quote the reference number, the product name and serial number.
This document can be obtained from our homepage www.montech.com.

Nameplate



Montech AG
Management

U. D. Wagner

C. Wullschleger

1.6. Validity of User Manual

Our products are continually updated to reflect the latest state of the art and practical experience. In line with product developments, our User Manuals are continually updated.
Every User Manual has a reference number (e.g. BA-100074) and an edition number (e.g. 02/2008). The reference number and the edition number are shown on the title page.

Validity

Main device:

Full name	Short name	Reference number
Electrical rotary unit –60	DAE–60	57835

Option:

Full name	Short name	Reference number
DAE-60 permanent magnet brake	-	57550

2. Technical data

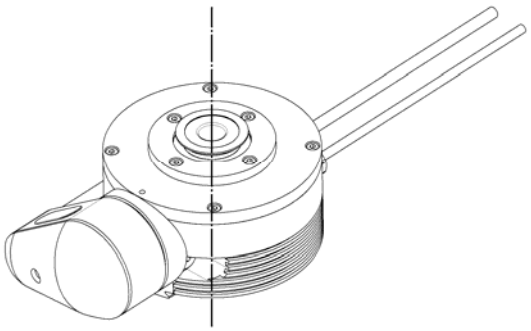
2.1. Technical data for DAE-60

				Vertical drive shaft	Horizontal drive shaft 6)
Max. rotation angle	φ_{max}		[°]	3600 (10 rotations)	
Max. mass moment of inertia	J_{max}	1)	[kgcm²]	400	250
Max. torque (dynamic)	M_{Dmax}	2)	[Nm]	2.4	3.0
Max. holding moment (static)	M_{Hmax}	3)	[Nm]	4.5	4.5
Max. tilting moment (static)	M_{Kmax}	4)	[Nm]	10	10
Max. axial force (static)	F_{amax}		[N]	± 450	± 450
Max. rotational speed	ω	1)	[°/s]	500	300
Max. angular acceleration	α	1)	[°/s²]	3000	2500
Weight			[kg]	2.20	
Drive				Brushless, electronic commutated DC motor, toothed belt and angular gear	
Motor rated power			[W]	60	
Encoder system				Encoder	
Protective class				IP 40	
Repeat precision		5)	[°]	± 0.01	
Play			[°]	Low backlash and adjustable	
Supply voltage / current				24VDC / 4A	
Reference point proximity switch				Integrated, inductive proximity switch PNP	
Noise pressure level			[dBA]	≤ 63	
Ambient	Temperature		[°C]	10…50	
	Rel. humidity		[%]	5%-85% (without condensation)	
	Purity of the air			Normal workshop atmosphere	

Maintenance	Grease miter gear
Warranty period	2 years from date of delivery
Material	Steel, aluminum, plastic

1) Measured at max. mass moment of inertia, max. rotational speed, and max. angular acceleration → see travel time diagram Section 2.3.
2) Torque or movement moment. Corresponds to the moment which is available on the drive shaft in order to move a load. → Section 2.6 Load calculation.
3) Holding moment or load of the drive due to a load on the drive shaft at standstill without it moving. → Section 2.6 Load calculation.
4) Tilting moment or load of the drive shaft due to a radial force element. → Section 2.6 Load calculation.
5) Measured at constant motor temperature, max. mass moment of inertia, max. rotational speed, max. angular acceleration, and 100 successive rotary movements in the same direction.
6) For use with drive horizontal drive shaft, a permanent magnet brake should be used. → Section 2.2 Optional permanent magnet brake.

Electrical rotary unit DAE-60, installation position: vertical drive shaft

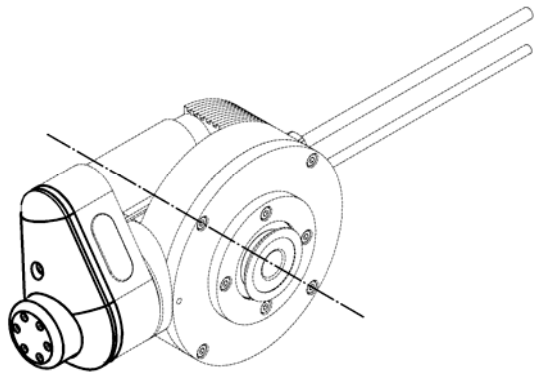


2.2. Option permanent magnet brake

With integrated permanent magnet brake 0.4 Nm, including housing and fixing screws.
The permanent magnet brake is recommended when the driving shaft of the DAE-60 is not oriented vertically.

Reference number		57550
Weight (without DAE-60)	[kg]	0.18
Type		Permanent magnet single-surface brake for dry running
Rated power	[W]	6.2
Voltage		24VDC

Electrical rotary unit DAE-60 with Permanent magnet brake, installation position: horizontal drive shaft

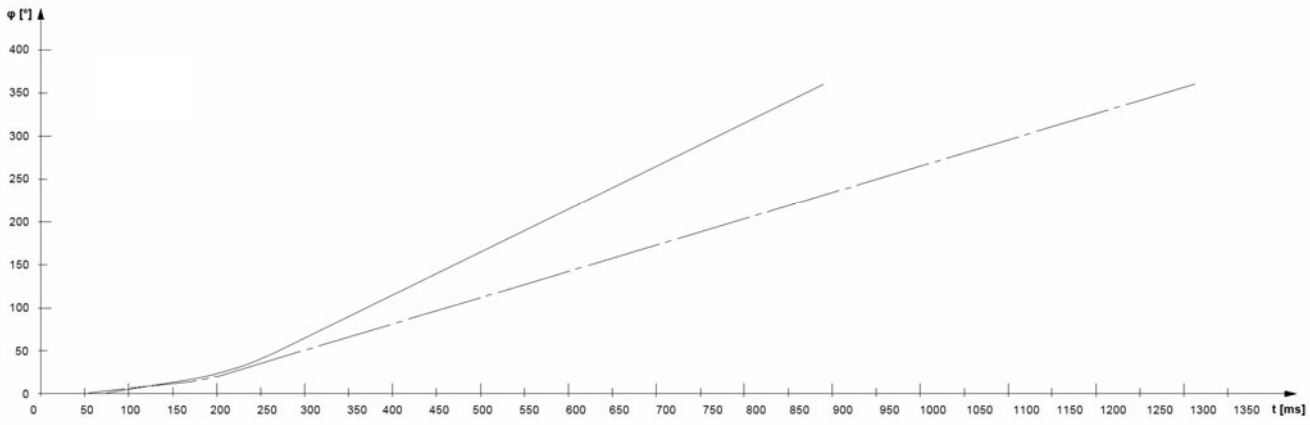


2.3. DAE-60 travel time

Travel times were determined under the following conditions:

Symbol	J		φ	ω		± α	
Unit	Kgcm²		°/1000	°/s		°/s²	
Position of the drive shaft	horizontal	vertical	-	horizontal	vertical	horizontal	vertical
Value	250	400	variable	300	500	2500	3000

- Beginning of the measurement with the "Start motion task" signal on ECMR terminal X5-6
- End of the measurement with the "INPOS" (in position) signal on ECMR terminal X7-3
- The travel time is measured between the signals "Start motion task" and "INPOS". "In position window" setting (ECMR software) = 250°/1000



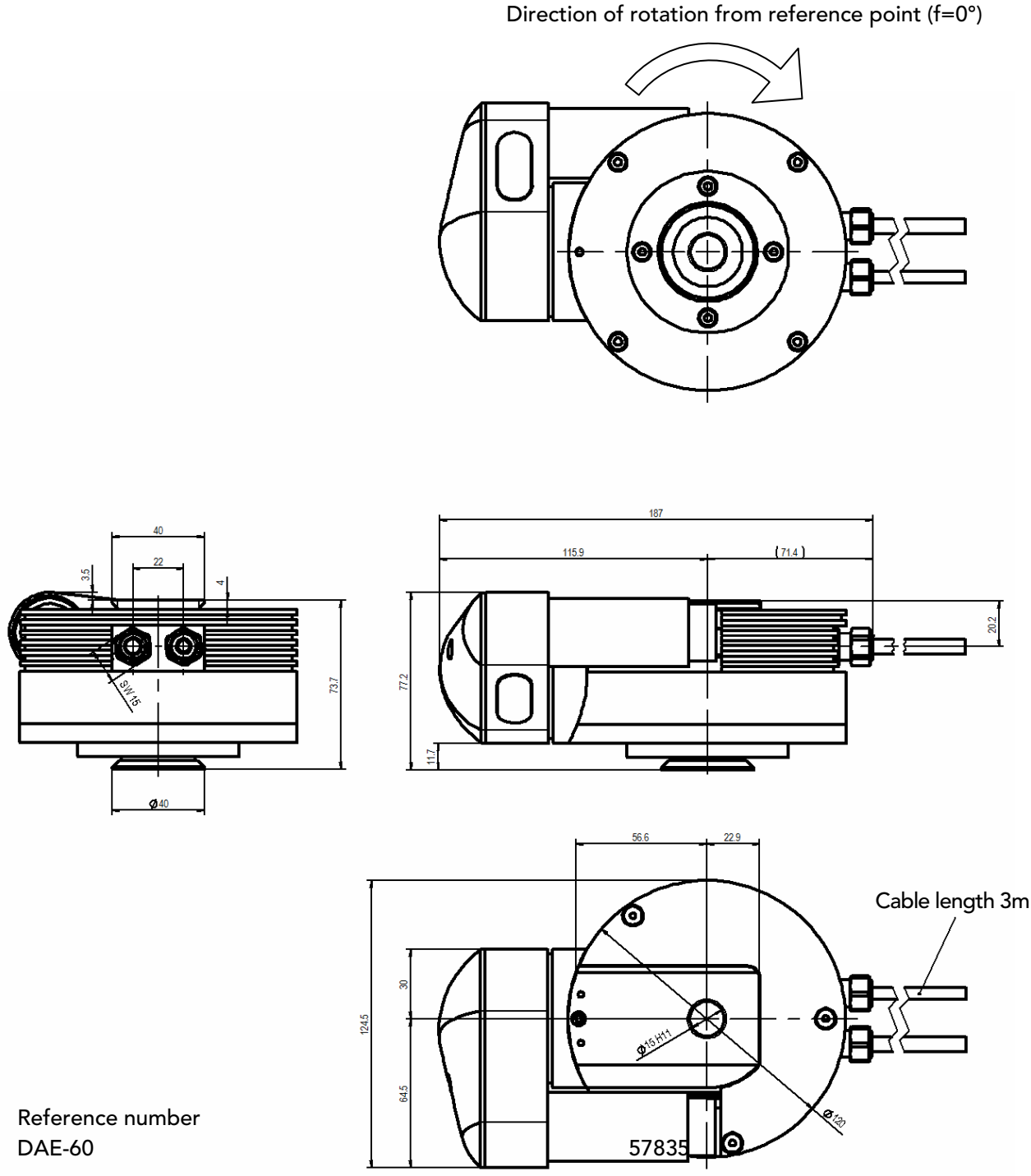
- - - - - horizontal

——— vertical

Symbol	Unit	Designation
J	[Kgcm²]	Mass moment of inertia of add-ons and/or load
t	[ms]	Travel time per rotation angle φ
φ	[°]	Rotation angle or stroke
ω	[°/s]	Rotational speed
±α	[°/s²]	+ α angular acceleration / - α angular delay

2.4. Dimensions

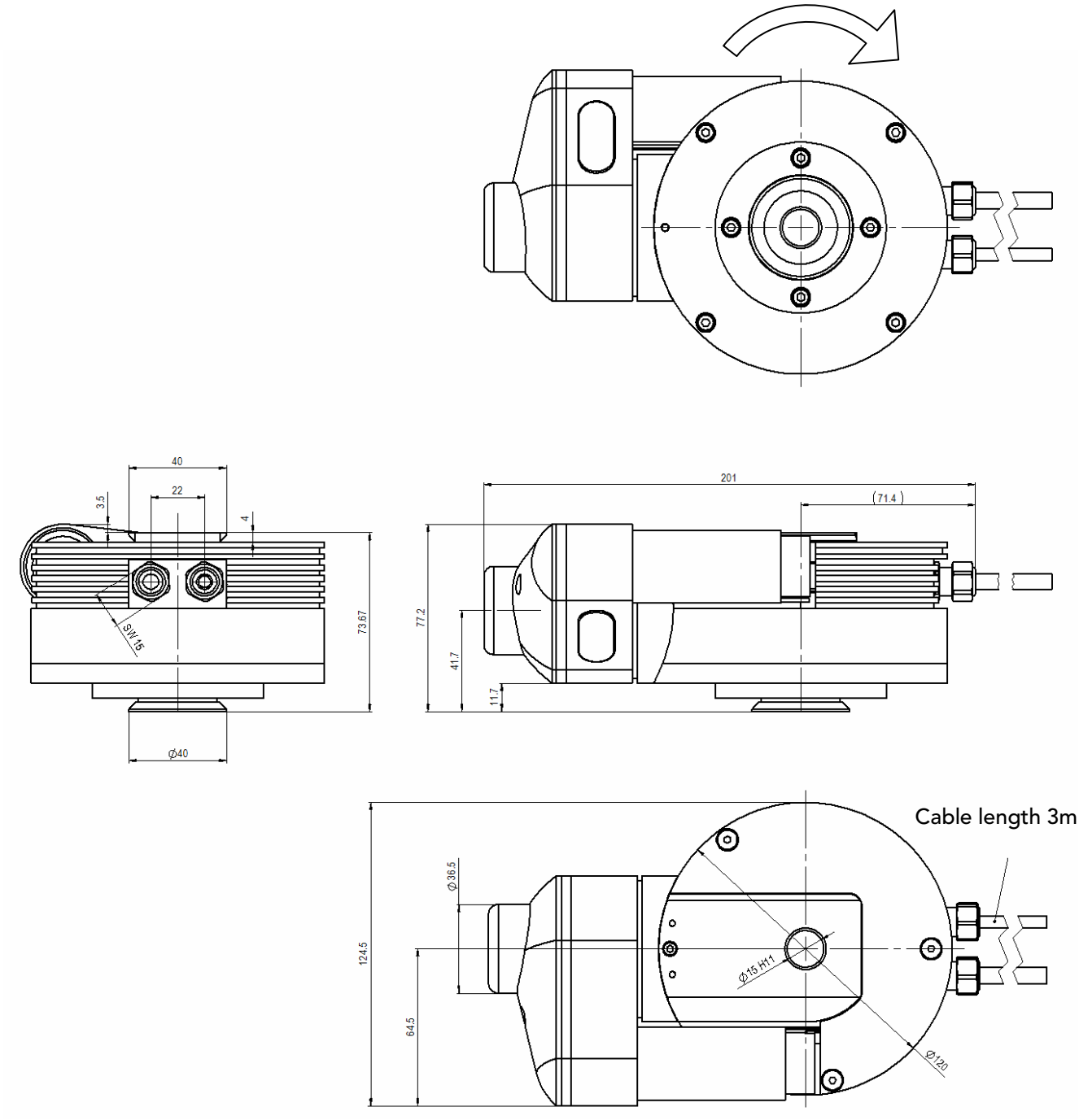
2.4.1. Dimensions of DAE-60



Reference number
DAE-60

2.4.2. Dimensions of DAE–60 with permanent magnet brake

Direction of rotation from reference point (f=0°)

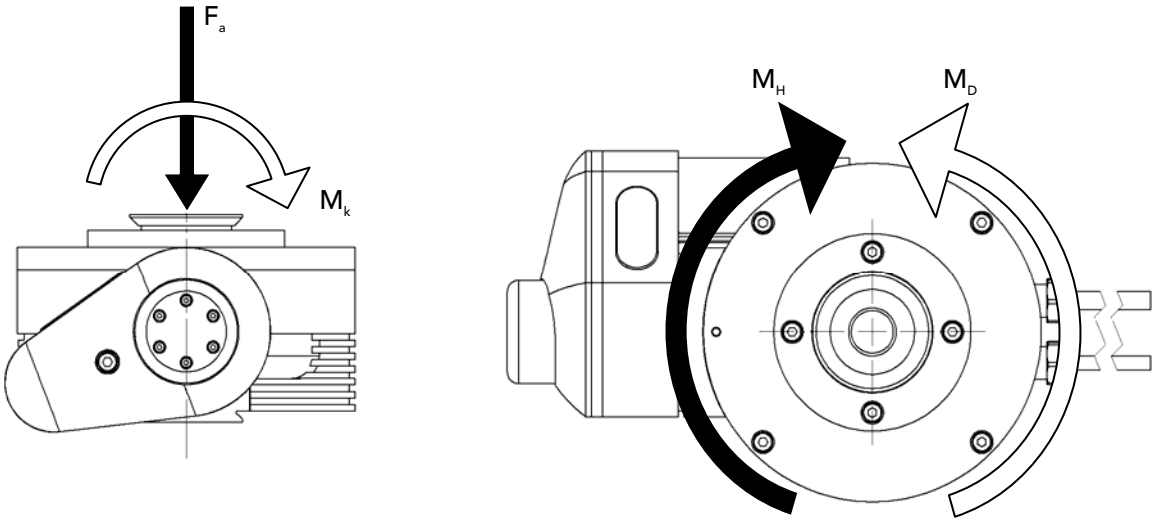


Reference number	
DAE-60 + permanent magnet brake	57835 + 57550

2.5. Scope of delivery

- Mechanical part including 3 m cable[1)] with loose ends for connecting to the ECMR controller.
- [1)] 3 m power cable: shielded and towable.
- [1)] 3 m data cable: unshielded and towable.
- ECMR controller completely configured with all counter connection terminals for connecting the loose wires.
- CD-ROM with Windows commissioning software and Operating Instructions in German, English, French and Italian.

2.6. Load calculation



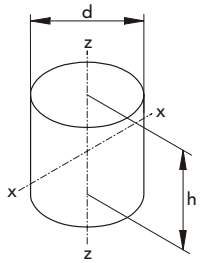
In Section 2.1 the maximum values are listed. They must not be exceeded.

This means:

Add-ons and load	Condition	Maximum value Section 2.1	Unit	Remark
	≤	α_{max}	[°/s²]	Angular acceleration
J	≤	J_{max}	[Kgcm²]	Mass moment of inertia
M_D	≤	M_{Dmax}	[Nm]	Torque (dynamic)
M_H	≤	M_{Hmax}	[Nm]	Holding moment (static)
M_k	≤	M_{kmax}	[Nm]	Tilting moment (static)
$\lvert\pm F_a\rvert$	≤	F_{amax}	[N]	Max. axial force (static) identical for tractive and compressive

2.7. Calculation of mass moments of inertia of parts

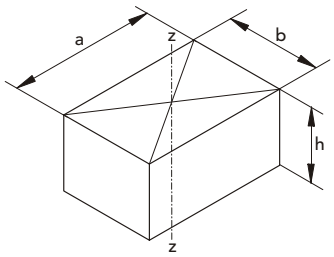
Calculation of mass moments of inertia generally



$$m = \frac{1}{4} \cdot \rho \cdot \pi \cdot d^2 \cdot h$$

$$J_z = \frac{1}{8} \cdot m \cdot d^2$$

$$J_x = \frac{1}{16} \cdot m \cdot \left(d^2 + \frac{4}{3} h^2 \right)$$



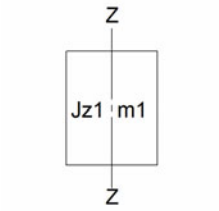
$$m = \rho \cdot a \cdot b \cdot h$$

$$J_z = \frac{1}{12} \cdot m \cdot \left(a^2 + b^2 \right)$$

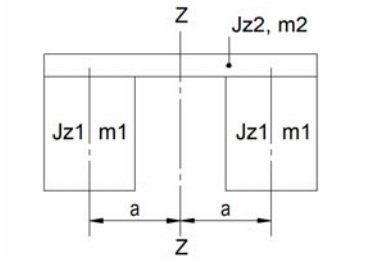
J_z	[kgcm^2]	Mass moment of inertia with axis of rotation z – z
J_x	[kgcm^2]	Mass moment of inertia with axis of rotation x – x
m	[kg]	Mass
ρ	[kg/cm^3]	Density
a	[cm]	Length
b	[cm]	Width
d	[cm]	Diameter
h	[cm]	Height

2.8. Calculation of mass moments of inertia of add-on units

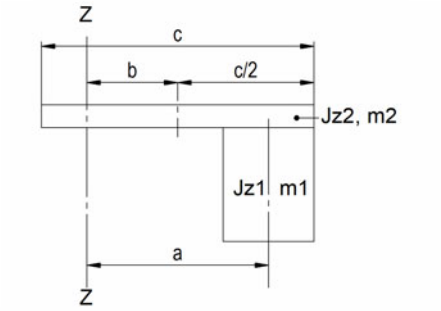
Total mass moments of inertia



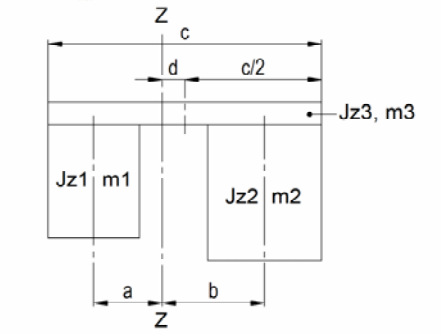
$J_{Tot} = J_{z1}$



$J_{Tot} = 2 \cdot (J_{z1} + m_1 \cdot a^2) + J_{z2}$



$J_{Tot} = J_{z1} + m_1 \cdot a^2 + J_{z2} + m_2 \cdot b^2$



$J_{Tot} = J_{z1} + m_1 \cdot a^2 + J_{z2} + m_2 \cdot b^2 + J_{z3} + m_3 \cdot d^2$

a, b, c, d	[cm]	Length
J_{Tot}	[kgcm^2]	Total mass moment of inertia of add-on units with axis of rotation Z – Z
J_{z1}, J_{z2}, J_{z3}	[kgcm^2]	Mass moment of inertia of the individual parts
m_1, m_2, m_3	[kg]	Mass of the individual parts
Z-Z	[-]	Axis of rotation

3. Commissioning

3.1. Installation position and assembly

Reference: Exploded view in chapter 5

As a rule, the housing (item 10) is fixed and the rotational movement is performed by the output shaft (item 90). The position of the output shaft (item 90) provides information about the DAE-60 version which is to be used.

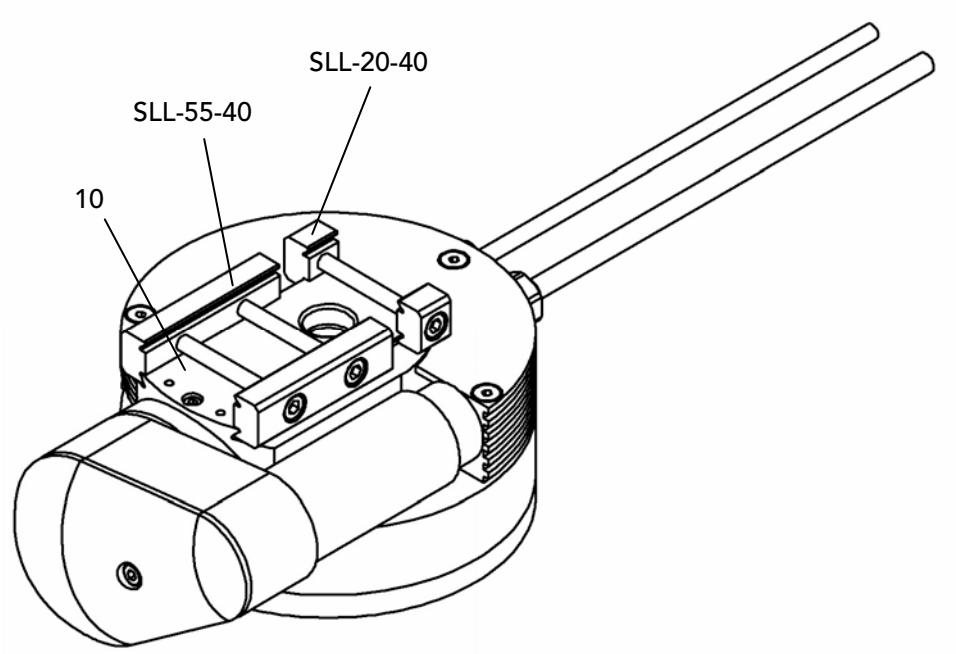
- The output shaft (item 90) is vertical: Device DAE–60 (reference number 57490) is suitable.
- The drive shaft pos. 90 is not vertical: the DAE–60 device (article no. 57490) with the optional permanent magnet brake (article no. 57550) is suitable.

Properties of the permanent magnet brake:

- In the case of a currentless (torque-free) motor, the load is held by the permanent magnet brake. A movement of the load is thus prevented. This is important especially if the output shaft (item 90) is not positioned vertically and the load would move by itself to the lowest position.
- The permanent magnet brake is not used by the motor for braking, since otherwise premature wear of the permanent magnet brake would occur.
- The permanent magnet brake becomes active only if the motor control unit is disabled or there is a power failure.

The DAE-60 is assembled by means of Quick-Set fixing elements on the dovetail of the housing (item 10). During assembly, the total length of the dovetail should as far as possible be used, as with a clamping element SLL-55-40 and a clamping element SLL-20-40.

Installation position and assembly



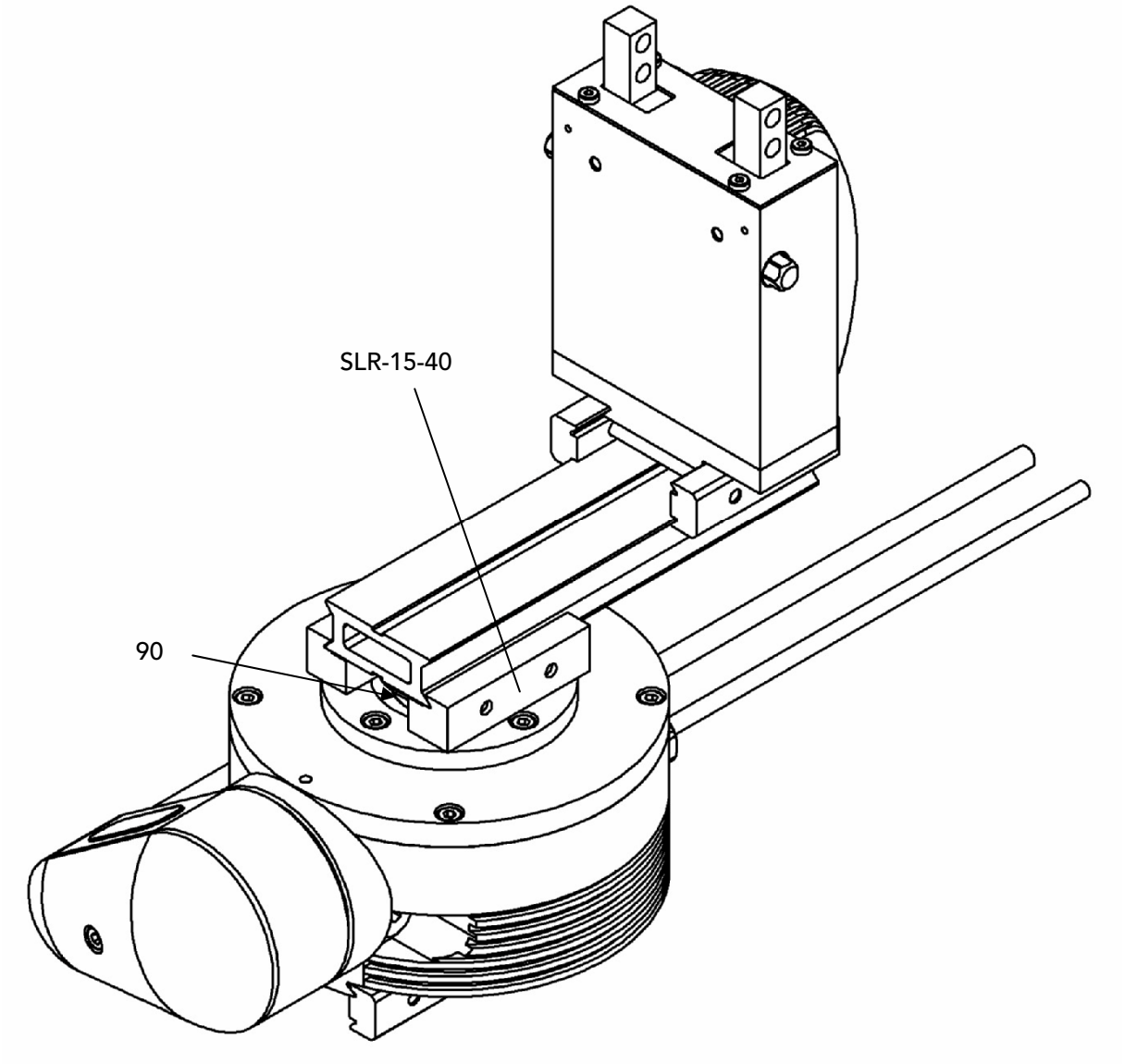
3.2. Mounting of the add-on units (load)

Reference: Exploded view in chapter 5

While complying with the permissible loads (see chapter 2.5), any add-on units can be fixed to the DAE-60.

The add-on units (load) are mounted by means of Quick-Set fixing elements SLR-15-40 on the output shaft (item 90).

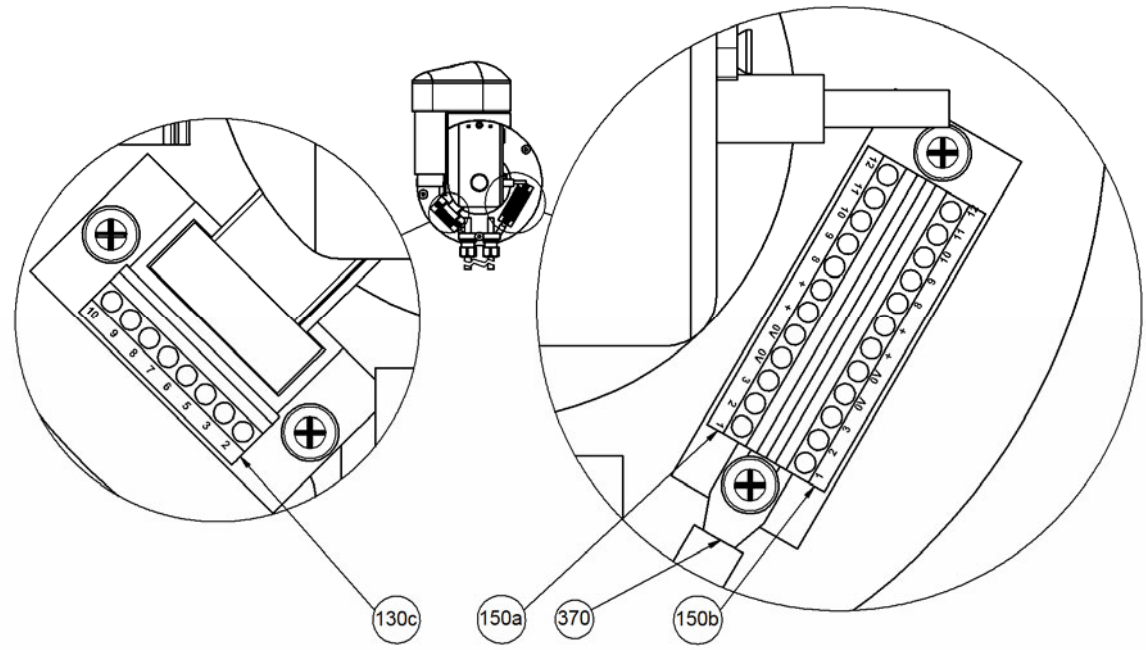
Mounting of the load



3.3. Internal wiring and cable connections

Introduction:
The DAE-60 is delivered completely wired. Only the cable ends have to be connected to the motor control.

Electrical terminal group:
Usually, it is not necessary to carry out work on the terminal group (item 130 and item 150).
Reference: Exploded view in chapter 5
The terminal groups are located under the cover (item 20). Loosen the 2 screws (item 530) and the screw (item 540) in order to remove the cover (item 20).



Legend:
Item 130c: terminal strip c
Item 150a: terminal strip a
Item 150b: terminal strip b
Item 370: screen connection

3.3.1. Motor

	Inside device		Output cable 3x0.5mm²	
Designation	**Wire color**	**Terminal**	**Wire color**	**Terminal**
Motor winding 1	Red	a 1	White	b 1
Motor winding 2	Black	a 2	Brown	b 2
Motor winding 3	White	a 3	Green	b 3
Screen connection	n.c.	n.c.	Screen	Item 370

	Inside device		Output cable 18x0.14mm²	
Designation	**Wire color**	**Terminal**	**Wire color**	**Terminal**
n.c.	n.c.	n.c.	White	n.c.
n.c.	n.c.	n.c.	Brown	n.c.
n.c.	n.c.	n.c.	Green	n.c.
Hall sensor 1	Yellow	a 8	Yellow	b 8
Hall sensor 2	Brown	a 9	Grey	b 9
Hall sensor 3	Grey	a 10	Pink	b 10
GND Hall sensor	Blue	a 0V	Blue	b 0V
U Hall sensor	Green	a +	Red	b +

Note:
n.c.: Not connected.

3.3.2. Encoder

	Inside device		Output cable 18x0.14mm²	
Designation	**Wire color**	**Terminal**	**Wire color**	**Terminal**
Vcc Encoder	Flat cable	Multipoint connector (plug)	Grey-pink	c 2
GND Encoder			Red-blue	c 3
A emer.			White-green	c 5
A			Brown-green	c 6
B emer.			White-yellow	c 7
B			Yellow-brown	c 8
I emer.			White-grey	c 9
I			Grey-brown	c 10

3.3.3. Inductive proximity switch

	Inside device		Output cable 18x0.14mm²	
Designation	**Wire color**	**Terminal**	**Wire color**	**Terminal**
U ind. proximity switch	Brown	a +	(Red)*	(b+)*
GND ind. proximity switch	Blue	a 0V	(Blue)**	(b 0V)**
Output	Black	a 11	Black	b 11

Note:
*: U ind. proximity switch is connected internally to U Hall sensors.
**: GND ind. proximity switch is connected internally to GND Hall sensors.

3.3.4. Permanent magnet brake

	Inside device		Output cable 18x0.14mm²	
Designation	**Wire color**	**Terminal**	**Wire color**	**Terminal**
GND permanent magnet brake	Blue	b 0V	(Blue)*	(b 0V)*
U permanent magnet brake	Red	a 12	Violet	b 12

Note:
*: GND permanent magnet brake is connected internally to GND Hall sensors.

3.4. Wiring the controller (ECMR)

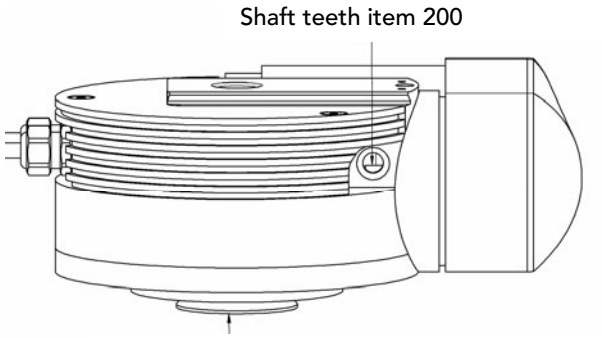
Please refer to Operating Instructions BA-100078 ECMR (EC Motor Controller), electrical and software part.

4. Mechanical design

4.1. Lubrication

Reference: exploded view in chapter 5

DAE-60 without lubrication stopper (item 340)



Only the miter gears (item 120 and item 200) require subsequent lubrication. It is essential to use only Klüber grease "Staburags NBU12/300KP" (Montech ref. no. 508501).

Lubrication interval: 800 operating hours

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- When working on the DAE-60, it is necessary to ensure that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

Preparation:
1. Stop all travel jobs.
2. Disable the motor control.
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.

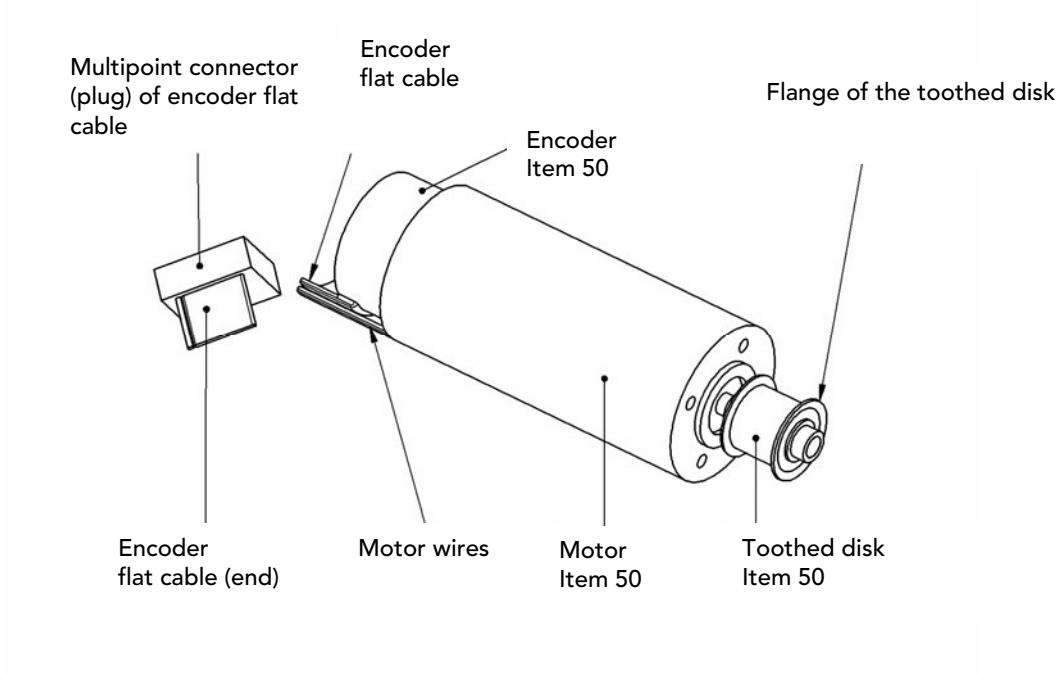
Lubrication:
4. Remove the lubrication stopper (item 340).
5. Lubricate the teeth of the shaft (item 200) by means of a thin and long object, e.g. a screwdriver. .> approx. 5ml Klüber grease "Staburags NBU12/300KP"
6. Turn the shaft (item 90) through approx. 45°.
7. Carry out the lubrication again as described above.
8. Repeat the lubrication process until a full revolution of the output shaft (item 90) has been achieved.
9. Install the lubrication stop (item 340) again and tighten.
10. If possible, move the output shaft (item 90) manually back and forth through 360° so that the grease is uniformly distributed.

Final work:
11. Switch on the voltage of the EC Motor Controller (ECMR).
12. Enable the EC Motor Controller (ECMR).
13. Carry out the reference travel.

4.2. Replacing the motor

Reference: exploded view in chapter 5

Motor with toothed disk



Introduction:
The motor with toothed disk (item 50) is a unit consisting of the following components:
- A motor with 8 wires.
- An encoder with flat cable and multipoint connector (plug)
- A toothed disk.

In order to replace the motor, the DAE must be dismantled and possibly even the add-on units.

– During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
– During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

Preparation:
1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
4. Dismantle the DAE-60 and if necessary also the add-on units.
5. Loosen the 2 screws (item 530) and the screw (item 540) and remove the cover (item 20).
6. Unplug the encoder multipoint connector (plug) (item 50).
7. Loosen the 2 screws (item 520) and remove the terminal group (item 150).
8. Loosen the screw (item 360) and remove the cover (item 40).

Replacing the motor:
9. Remove all wires of the motor (item 50) from the terminal strip (item 150). → Chapter 3.3.1
10. Remove the 4 screws (item 390) so that the motor (item 50) is free.
11. Tilt the motor (item 50) as obliquely as possible and remove carefully.
12. Insert the new motor (item 50) obliquely into the housing (item 30). Carefully push the toothed belt over the flange of the toothed disk (item 50). Slowly position the motor (item 50) perpendicular to the housing (item 30).
13. Fix the motor (item 50) with the 4 screws (item 390) on the housing (item 30). Tighten the screws (item 390) only lightly so that the motor can still be moved.
14. Connect all wires of the motor (item 50) to the terminal strip (item 150). → Chapter 3.3.1.
15. Fix the terminal group (item 150) with the 2 screws (item 520) on the housing (item 10). Do not forget the screen connection (item 370) or cable lug.
16. Insert the encoder multipoint connector (plug) (item 50) on the terminal group (item 130).
17. Fix the cover (item 20) with 2 screws (item 530) and the screw (item 540) on the housing (item 10).

Toothed belt tension:
18. Remove the motor (item 50) so that the toothed belt (item 400) is slightly tensioned.
19. Hold the motor (item 50) and tighten the 4 screws (item 390).
20. Fix the cover (item 40) with the screw (item 360) on the housing (item 30).

The zero point adjustment:
→ Chapter 4.5 from point 3.

4.3. Replacing the toothed belt

Reference: exploded view in chapter 5

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.
- Excessively strong tensioning of the toothed belt (item 400) can lead to destruction of the motor bearing.

Preparation:

1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
4. Loosen the screw (item 360) and remove the cover (item 40)

Replacement of toothed belt:

5. Remove the 4 screws (item 390) so that the motor (item 50) is free.
6. Tilt the motor (item 50) as obliquely as possible.
7. Remove the toothed belt (item 400).
8. First push the new toothed belt (item 400) onto the toothed disk of the motor (item 50).
9. Carefully push the toothed belt over the toothed disk (item 180). Slowly position the motor (item 50) perpendicular to the housing (item 30).
10. Fix the motor (item 50) with the 4 screws (item 390) on the housing (item 30). Only slightly tighten the 4 screws (item 390) so that the motor can still be moved.

Toothed belt tension:

→ Chapter 4.4 from point 6.

4.4. Toothed belt tension

Reference: exploded view in chapter 5

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.
- Excessively strong tensioning of the toothed belt (item 400) can lead to destruction of the motor bearing.

Preparation:

1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.

Toothed belt tension:

4. Loosen the screw (item 360) and remove the cover (item 40).
5. Slightly loosen the 4 screws (item 390). The motor (item 50) can be moved but is not loose.
6. Move the motor (item 50) so that the toothed belt (item 400) is lightly tensioned.
7. Hold the motor (item 50) and tighten the 4 screws (item 390).
8. Fix the cover (item 40) with the screw (item 360) on the housing (item 30).

Final work:

9. Switch on the voltage of the EC Motor Controller (ECMR).
10. Enable the EC Motor Controller (ECMR).
11. Carry out the reference travel.
12. Check the position of the add-on units.
13. Small positional corrections can be made with the function “reference offset” in the software. If larger positional corrections are required, the load can be repositioned.

4.5. Zero point adjustment

Reference: exploded view in chapter 5

Introduction:
In the zero point adjustment, mechanical zero point (reference) of the DAE-60 is established. In order to determine the zero point, reference travel is initiated. If the reference travel is started, the following takes place:
The output shaft (item 90) first rotates counter clockwise until the inductive proximity switch (item 550) responds. Once the inductive proximity switch (item 550) has responded, the output shaft (item 90) stops and then rotates more slowly in the opposite direction. On reaching the encoder index, the output shaft (item 90) stops again. The reference travel is now complete. The entire procedure takes place automatically.

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

Preparation:
1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
4. Build up the DAE-60 on a firm substructure, unless this has already been done.
5. Remove the add-on units if necessary.
6. Switch on the voltage of the EC Motor Controller (ECMR) again.

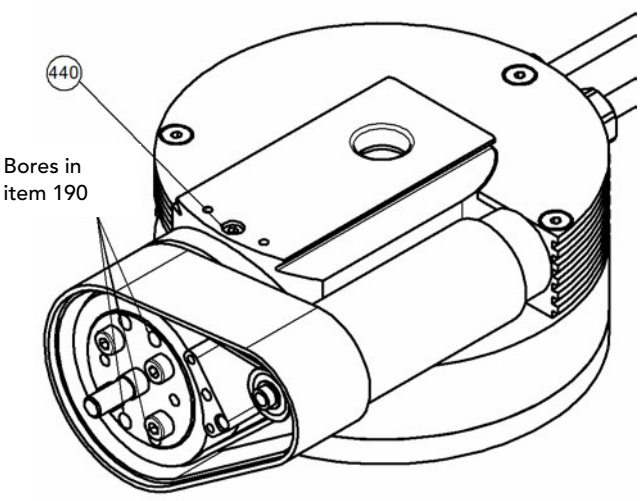
Zero point adjustment:
7. Start the reference travel with the software and wait until the output shaft (item 90) finally remains stationary.
8. Using the software, check that the reference travel is complete.
9. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
10. Mount the add-on units again. Ensure that the output shaft (item 90) is moved as little as possible.

Final work:
11. Switch on the voltage of the EC Motor Controller (ECMR).
12. Start the reference travel with the software again. Ensure that the add-on units permit reference travel and that there is no obstacle in the way.
13. Small positional corrections can be made with the function “reference offset” in the software. If larger corrections to the position are required, the load can be repositioned.

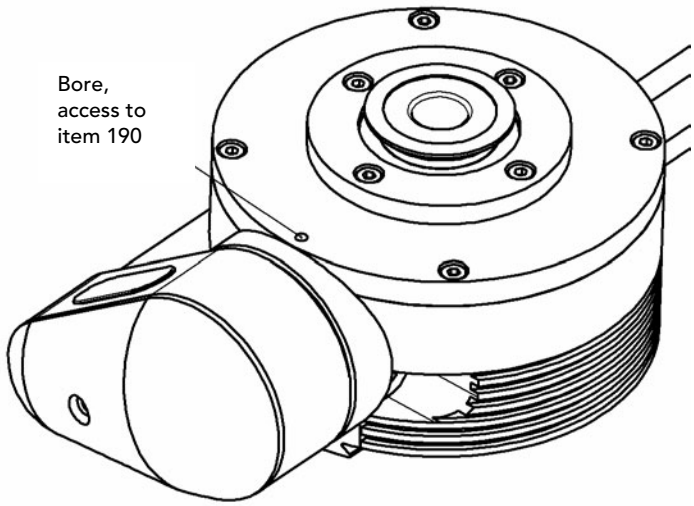
4.6. Adjustment of gear play

Reference: exploded view in chapter 5

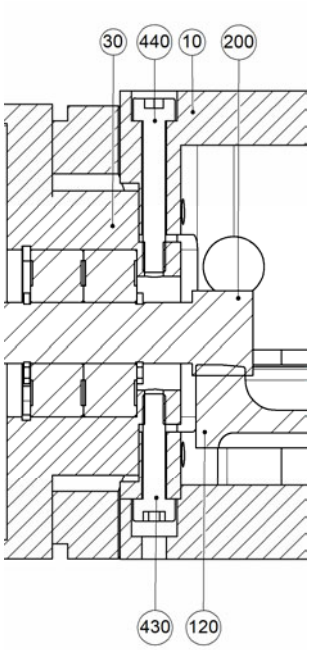
Isometric view from above (without cover, item 40)



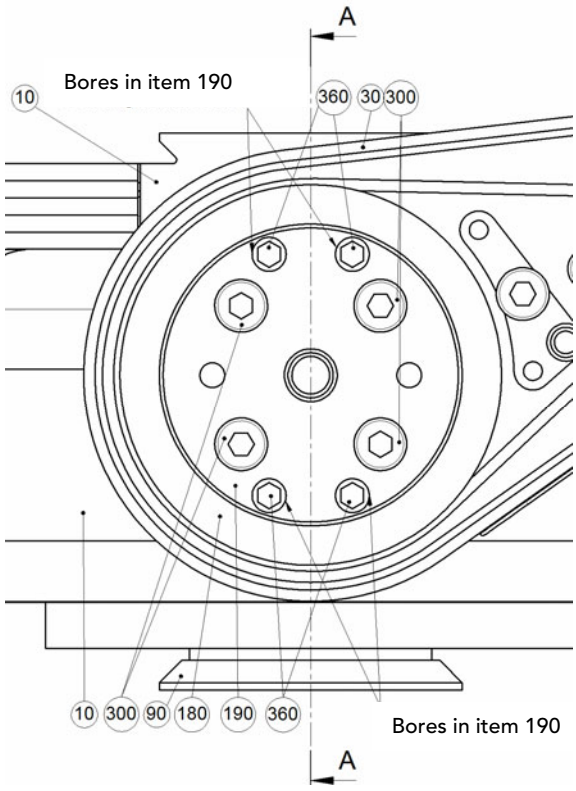
Isometric view from below



Sectional view A-A



Side view



Note:
The gear play has already been set at the factory and usually does not need to be adjusted.

Overview:
The housing (item 10) contains a miter gear consisting of a crown wheel (item 120) and a pinion (shaft) (item 200). The gear play is adjusted by moving the housing (item 30) with the screws (item 430 and 440). The screws (item 430 and item 440) are used for adjusting the gear play and must never be tightened. The screw (item 430) is reached through a bore in the flange (item 60).
The housing is guided by 2 guides (item 70) and is screwed tight by means of 4 screws (item 360). In order to reach the 4 screws (item 360) through the bores in the flange (item 190) and the pinion (item 180), the pinion (item 180) is turned until the position according to the above drawing "side view" is reached.

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the motor control is switched off and cannot be switched on by unauthorized persons.
- The adjustment of the gear play must be carried out carefully, since otherwise premature wear of the teeth and/or overloading of the motor may occur.

Preparation:
1. Stop all travel jobs.
2. Disable the motor control.
3. Switch off the voltage of the motor control and ensure that it cannot be switched on by unauthorized persons
4. Loosen the screw (item 360) and remove the cover (item 40).
5. Turn on the pinion (item 180) until all 4 bores correspond to the positions of the screws (item 360).
6. Loosen the screws (item 360) as far as they will go and then tighten again by two revolutions. The screws (item 360) cannot be removed.
7. Slightly loosen the screws (item 430 and 440). The screw (item 430) cannot be removed. The housing (item 30) can now be pushed to and fro.

The adjustment:

8. Slightly tighten the screw (item 440) until there is marked play. Never tighten the screw (item 440) firmly.
9. Lightly tighten the screw (item 430) until the housing (item 30) can no longer move. Never tighten the screw (item 430) firmly.
10. Alternately and in sequence: loosen the screw (item 440) by 1/6 turn; tighten the screw (item 430) by 1/6 turn; check the play. Use this procedure until play is no longer noticeable.
    The play is best checked by the following procedure: the output shaft (item 90) is moved with one hand and the screws (item 300) of the flange (item 190) are held with the other hand. The play should be checked approximately every 90° over a full revolution of the output shaft (item 90).
    Due to the manufacturing tolerances, the backlash cannot always be completely eliminated over a whole turn of the driving shaft Pos.90.
    The adjustment is complete as soon as a free backlash adjustment is reached, in any position of the driving shaft Pos.90.

Final work:

11. Tighten the 4 screws (item 360).
12. Fix the cover (item 40) with screw (item 360) on the housing (item 30).
13. Switch on the voltage of the EC Motor Controller (ECMR).
14. Enable the EC Motor Controller (ECMR).
15. Carry out the reference travel.

4.7. Option: permanent magnet brake

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.
- The air gap must not exceed or be less than the specified value. → Chapter 4.7.3
- The mounted components, in particular the friction surfaces, must be free of grease.

Note:
The chapter 1 up to and including 3 is also applicable to the permanent magnet brake.

Permanent magnet brake actuation in the automatic mode:
The scope of delivery of the DAE-60, ref. no. 57490, includes a EC Motor Controller (ECMR) with housing, ref. no. 57332. The EC Motor Controller (ECMR) is preset at the factory and autonomously performs the actuation of the permanent magnet brake.

Permanent magnet brake actuation in manual mode:
In the next operations, the permanent magnet brake is to be manually vented while the EC Motor Controller (ECMR) is switched off. For this purpose, it is necessary to provide a switch which makes it possible to switch the voltage supply of the permanent magnet brake manually on and off.

Function:
1. Voltage applied →permanent magnet brake vented → air gap between armature and hub of the permanent magnet brake → shaft torque–free.
2. No voltage applied → permanent magnet brake fixed → no air gap between armature and hub of the permanent magnet brake→ shaft fixed.

4.7.1. Mounting the permanent magnet brake

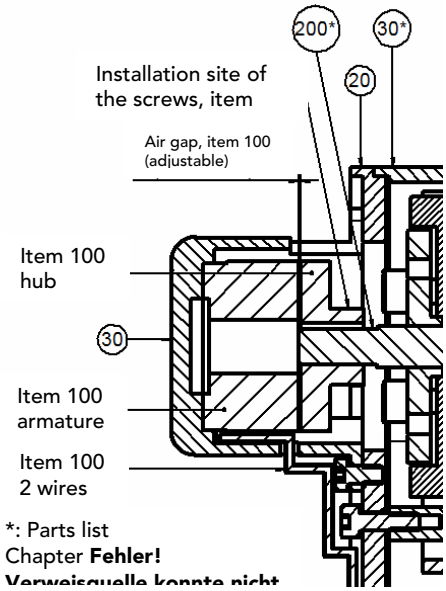
Reference: exploded view in chapter 5.1

Validity:
For retrofitting an existing DAE-60 device, ref. no. 57490, with a DAE-60 permanent magnet brake, ref. no. 57550.

State on delivery of DAE-60 permanent magnet brake, ref. no. 57550
The permanent magnet brake DAE-60 is completely assembled. A protective transport foil is present between the 2 brake surfaces of the permanent magnet brake (item 100). This protective transport foil must be removed before installation.

- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

DAE-60 with permanent magnet brake without cover (item 10), sectional view from above.



Preparation:
1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.

--> Reference: exploded view in chapter 5

4. Loosen the 2 screws (item 530) and the screw (item 540) and remove the cover (item 20).
5. Loosen the screw (item 360) and remove the cover (item 40). These parts are no longer required.
6. Remove stopper (item 410). This part is no longer required.

Mounting the permanent magnet brake:
--> Reference: exploded view in chapter 5.1
1. Loosen the screw (item 110) and remove the cover (item 10).
2. Remove the hub (item 100) and take away the protective transport foil (in the air gap).
3. Loosen the 2 screws (item 180) but do not remove.
4. Mount the hub (item 100) on the shaft (item 200*). The hub should be pushed on to the shaft by approx. 2 mm, so that it is not flush.
5. Tighten the 2 screws (item 180).
6. Lead the 2 wires of the permanent magnet brake (item 100) through the bore (Ø 4.0 mm) of the housing (item 30*).

--> Reference: exploded view in chapter 5

14. The 2 wires are laid further between the motor (item 50) and the housing (item 10). In the DAE-60 (below the cover, item 20), the 2 wires are led with the motor wires (item 50) to the terminal (item 150). Connect wires to the terminal group (item 150) → Chapter 3.3.4

15. Fix the cover (item 20) with the 2 screws (item 530) and the screw (item 540) on the housing (item 10).

--> Reference: exploded view in chapter 5.1

16. Fix the holder (item 20) with the 2 screws (item 190) on the housing (item 30*). The following should be noted in this operation.
The wires of the permanent magnet brake (item 100) must be lightly tightened during mounting so that no loop forms behind the holder (item 20).

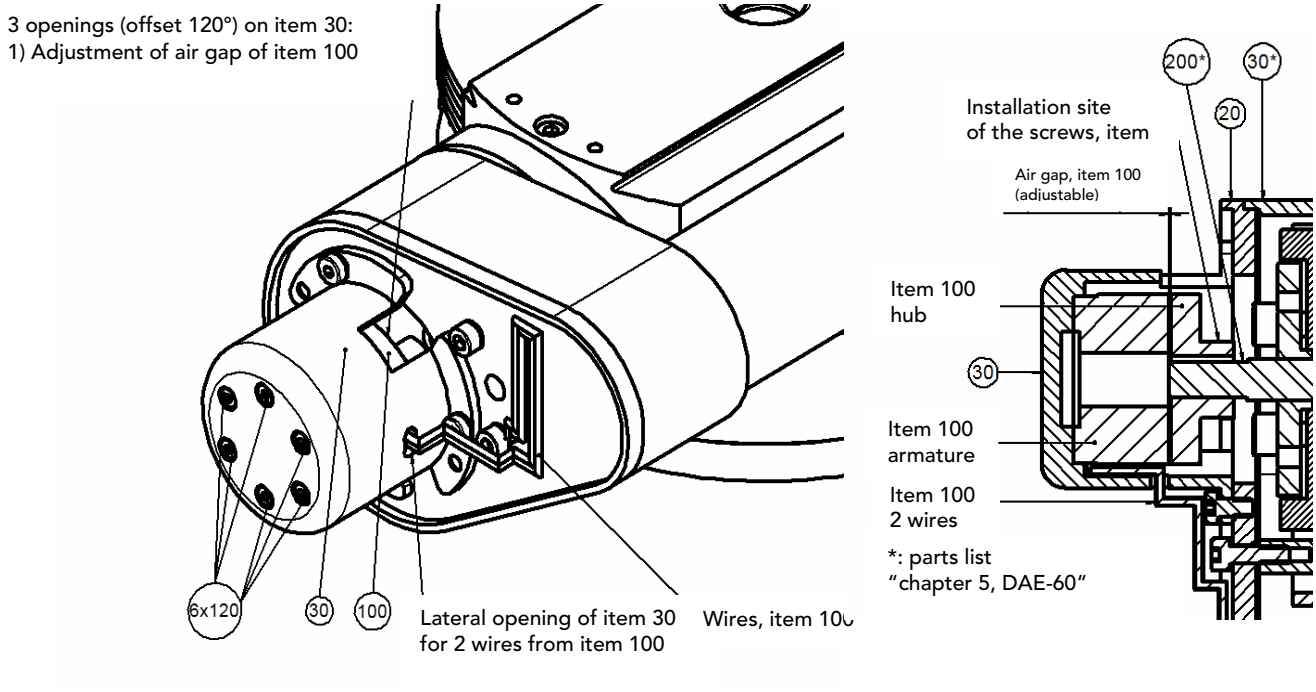
Adjustment or checking of the air gap:
→ Chapter 4.7.1 from point 5.

4.7.2. Replacement of the permanent magnet brake

Reference: exploded view in chapter 5.1

DAE-60 with permanent magnet brake without cover (item 10).

ISO view . *Sectional view (viewed from above)*



- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

Preparation:

1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
4. Loosen the screw (item 110) and remove the cover (item 10).

--> Reference: exploded view in chapter 5

5. Loosen the 2 screws (item 530) and the screw (item 540) and remove the cover (item 20).

Removing the existing permanent magnet brake:

6. Remove the 2 wires (item 100) (ref. exploded view in chapter 5.1) from the terminal group (item 150) (ref. exploded view in chapter 5). → chapter 3.3.4

--> Reference: exploded view in chapter 5.1

7. Carefully pull the 2 wires (item 100) out of the bore (Ø 4.0 mm) in the holder (item 20).
8. Vent the permanent magnet brake. → Chapter 4.7
9. Loosen the 3 screws (item 140) and remove the cover (item 30). The armature (item 100) is present in the cover (item 30).
10. Switch off the voltage of the permanent magnet brake.
11. Loosen the 6 screws (item 120) and remove the armature (item 100).
12. Loosen the 2 screws (item 180) and remove the hub (item 100) from the shaft (item 200*).

Mounting the new permanent magnet brake:

13. Lead the 2 wires of the permanent magnet brake (item 100) through the lateral opening of the cover (item 30). The wires are led from the inside to the outside.
14. Guide the permanent magnet brake (item 100) into the cover (item 30). In this operation, the following should be noted.
    During the introduction of the permanent magnet brake (item 100), hold the 2 wires close to the armature housing (item 100). The wires must not form a loop in the cover (item 30). Note the positioning of the armature (item 100). The wires should be led straight to the lateral opening of the cover (item 30) and not wound around the armature (item 100).
15. Fix the armature (item 100) with the 6 screws (item 120) in the cover (item 30).
16. Fix the cover (item 30) (with the new permanent magnet brake, item 100) using the 3 screws (item 140) on the holder (item 20). Note the positioning of the cover (item 30) on the holder (item 20).
17. Lead the 2 wires (item 100) through the bore (Ø 4.0 mm) in the holder (item 20).

Further work:

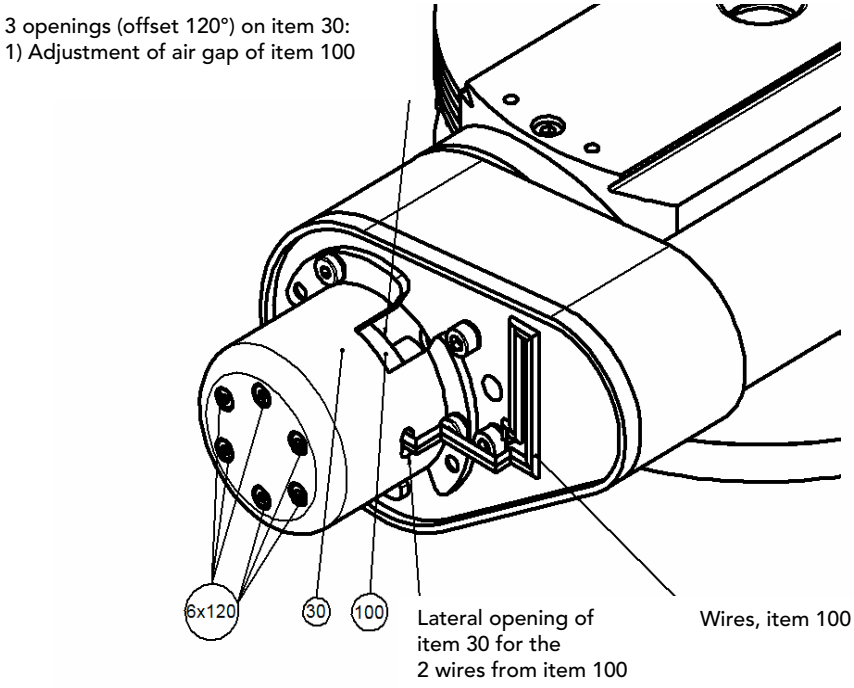
→ Chapter 4.7.1 from point 9.

4.7.3. Air gap adjustment of the permanent magnet brake

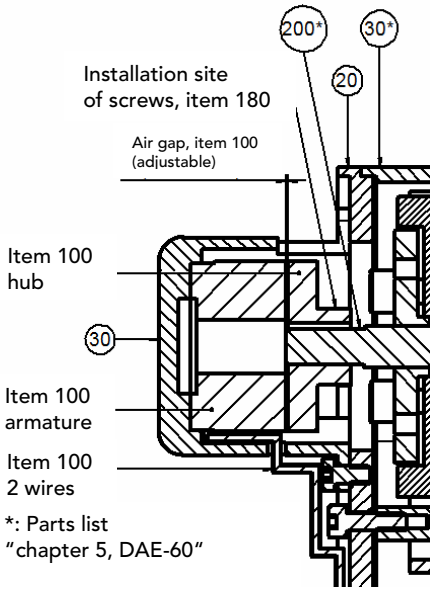
Reference: exploded view in chapter 5.1

DAE-60 with permanent magnet brake without cover (item 10)

ISO view


3 openings (offset 120°) on item 30:
1) Adjustment of air gap of item 100
6x120
30
100
Lateral opening of item 30 for the 2 wires from item 100
Wires, item 100

Sectional view (viewed from above)



- During operation the surfaces of the motor and permanent magnet brake can reach 100°C. Do not touch the parts until they have cooled to below 40°C (measure the surface temperature).
- During work on the DAE-60, it must be ensured that the unit energy of the EC Motor Controller (ECMR) is switched off and cannot be switched on by unauthorized persons.

Preparation:

1. Stop all travel jobs.
2. Disable the EC Motor Controller (ECMR).
3. Switch off the voltage of the EC Motor Controller (ECMR) and ensure that it cannot be switched on by unauthorized persons.
4. Loosen the screw (item 110) and remove the cover (item 10).

Adjustment:
5. Vent the permanent magnet brake. → Chapter 4.7
6. Turn the output shaft (item 90) (exploded view in chapter 5) until both screws (item 180) are visible in one opening each of the cover (item 30).
7. The air gap between the brake surfaces of the permanent magnet brake (item 100), reachable through the openings of the cover (item 30), should be within the tolerance.

Air gap tolerance		
Nominal value	[mm]	$0.3_{-0.05}$
Minimum value	[mm]	0.15
Maximum value	[mm]	0.35

7. Slightly loosen the 2 screws (item 180).
9. Adjust the air gap and tighten the 2 screws (item 180).
10. Check the air gap.
11. Switch off the voltage of the permanent magnet brake.

Final work:
11. Carefully fold the 2 wires (item 100) and fix the cover (item 10) with the screw (item 110).
12. Switch on the voltage of the EC Motor Controller (ECMR).
13. Enable the EC Motor Controller (ECMR).
14. Carry out the reference travel.

4.7.4. Lubrication (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.1, it being necessary to take into account the following differences:

Specific operation for DAE-60 with permanent magnet brake:
5a. Additional operation.
Vent the permanent magnet brake. → Chapter 4.7.
10a. Additional operation.
Switch off the voltage of the permanent magnet brake.

4.7.5. Replacing the motor (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.2, it being necessary to take into account the following differences:
Specific operation for DAE-60 with permanent magnet brake:
--> Reference: exploded view in chapter 5.1

8. Replaces the description in the chapter 4.2
   Loosen the screw (item 110) and remove the cover (item 10).

8a. Additional operation.
   Vent the permanent magnet brake. → Chapter 4.7

8b. Additional operation.
   Loosen the 2 screws (item 190) and carefully remove the holder (item 20). The following should be noted:
   The 2 wires of the permanent magnet brake should not be subjected to mechanical stress.

20. Replaces the description in the chapter 4.2
   Fix the holder (item 20) with the 2 screws (item 190) on the housing (item 30*). In this operation, the following should be noted.
   The wires of the permanent magnet brake (item 100) must be lightly tightened during mounting so that no loop forms behind the holder (item 20).

20a. Additional operation.
   Check the air gap. → Chapter 4.7.3

20b. Additional operation.
   Carefully fold the 2 wires (item 100) and fix the cover (item 10) with the screw (item 110).

4.7.6. Replacing the toothed belt (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.3 it being necessary to take into account the following differences:
Specific operation for DAE-60 with permanent magnet brake:
--> Reference: exploded view in chapter 5.1

5. Replaces the description in the chapter 4.3
   Loosen the screw (item 110) and remove the cover (item 10).

5a. Additional operation.
   Vent the permanent magnet brake. → Chapter 4.7

5b. Additional operation.
   Loosen the 2 screws (item 190) and carefully remove the holder (item 20). The following should be noted:
   The 2 wires of the permanent magnet brake (item 100) should not be subjected to mechanical stress.

8. Replaces the description in the chapter 4.3
   Carefully push the toothed belt over the holder (item 20) and the cover (item 30) and remove.

9. Replaces the description in the chapter 4.3
   First carefully push the new toothed belt over the holder (item 20) and the cover (item 30) and then push onto the toothed disk of the motor (item 50).

Toothed belt tension
→ Chapter 4.7.7

4.7.7. Toothed belt tension (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.4, it being necessary to take into account the following differences:

Specific operation for DAE-60 with permanent magnet brake:
--> Reference: exploded view in chapter 5.1

4. Replaces the description in the chapter 4.4
   Loosen the screw (item 110) and remove the cover (item 10).

4a. Additional operation.
   Vent the permanent magnet brake. → Chapter 4.7

4b. Additional operation.
   Loosen the 2 screws (item 190) and carefully remove the holder (item 20). The following should be noted:
   The 2 wires of the permanent magnet brake (item 100) should not be subjected to mechanical stress.

8. Replaces the description in the chapter 4.4
   Fix the holder (item 20) with the 2 screws (item 190) on the housing (item 30*). In this operation, the following should be noted.
   The wires of the permanent magnet brake (item 100) must be lightly tightened during mounting so that no loop forms behind the holder (item 20).

8a. Additional operation.
   Check the air gap. → Chapter 4.7.3

8b. Additional operation.
   Switch off voltage of the permanent magnet brake.

8c. Additional operation.
   Carefully fold the 2 wires (item 100) and fix the cover (item 10) with the screw (item 110).

4.7.8. Zero point adjustment (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.5.

4.7.9. Gear play adjustment (DAE-60 with permanent magnet brake)

All relevant information is mentioned in the chapter 4.6, it being necessary to take into account the following differences:

Specific operation for DAE-60 with permanent magnet brake:
--> Reference: exploded view in chapter 5.1

4. Replaces the description in the chapter 4.6
   Loosen the screw (item 110) and remove the cover (item 10).

4a. Additional operation.
   Vent the permanent magnet brake. → Chapter 4.7

4b. Additional operation.
   Loosen the 2 screws (item 190) and carefully remove the holder (item 20). The following should be taken into account:
   The 2 wires of the permanent magnet brake (item 100) should not be subjected to mechanical stress.

12. Replaces the description in the chapter 4.6
   Fix the holder (item 20) with the 2 screws (item 190) on the housing (item 30*). In this operation, the following should be taken into account.
   The wires of the permanent magnet brake (item 100) must be lightly tightened during mounting so that no loop forms behind the holder (item 20).

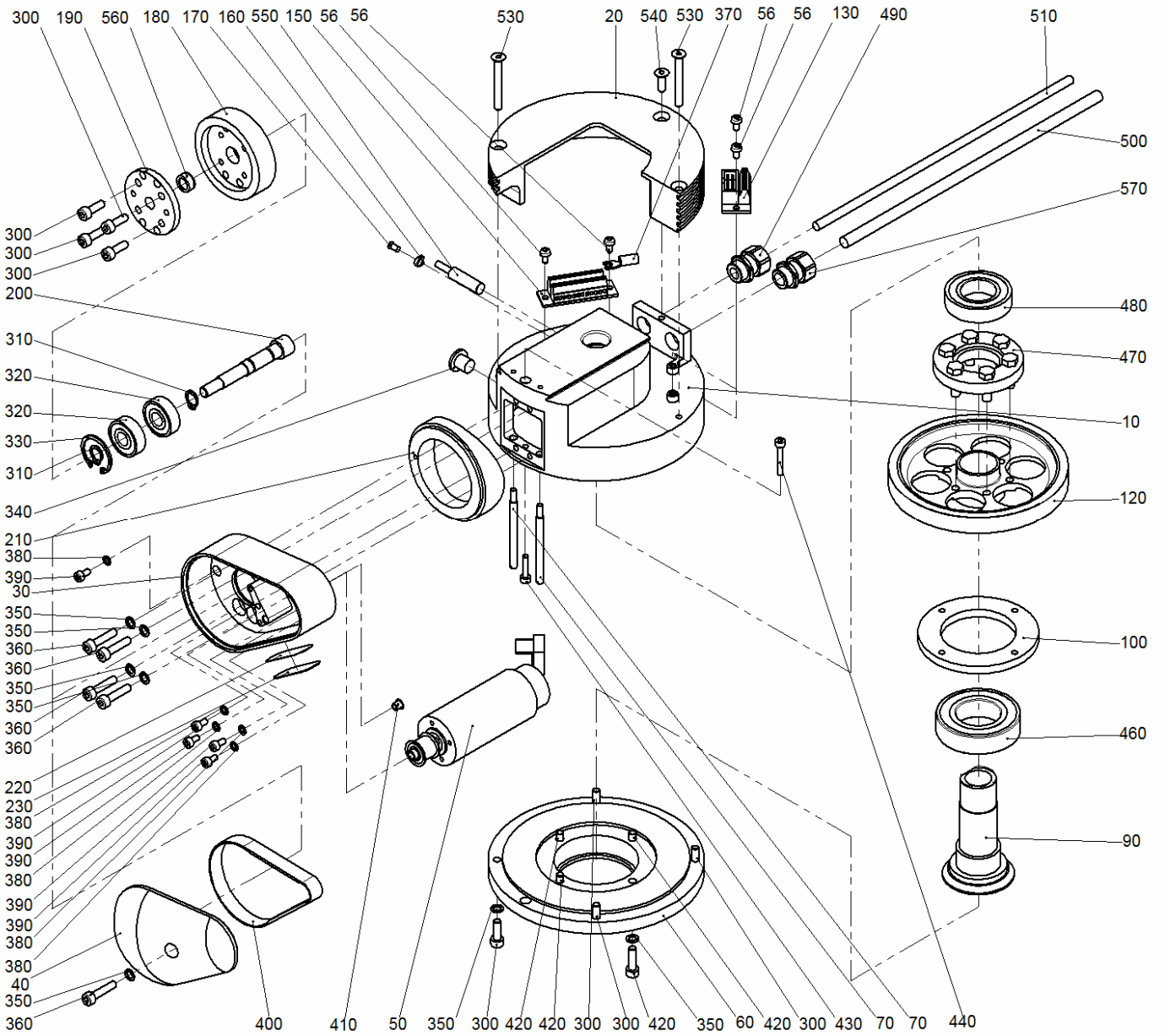
12a. Additional operation.
   Check the air gap. → Chapter 4.7.3

12b. Additional operation.
   Switch off the voltage of the permanent magnet brake.

12c. Additional operation.
   Carefully fold the 2 wires (item 100) and fix the cover (item 10) with the screw (item 110).

5. Parts list for DAE-60

Exploded view



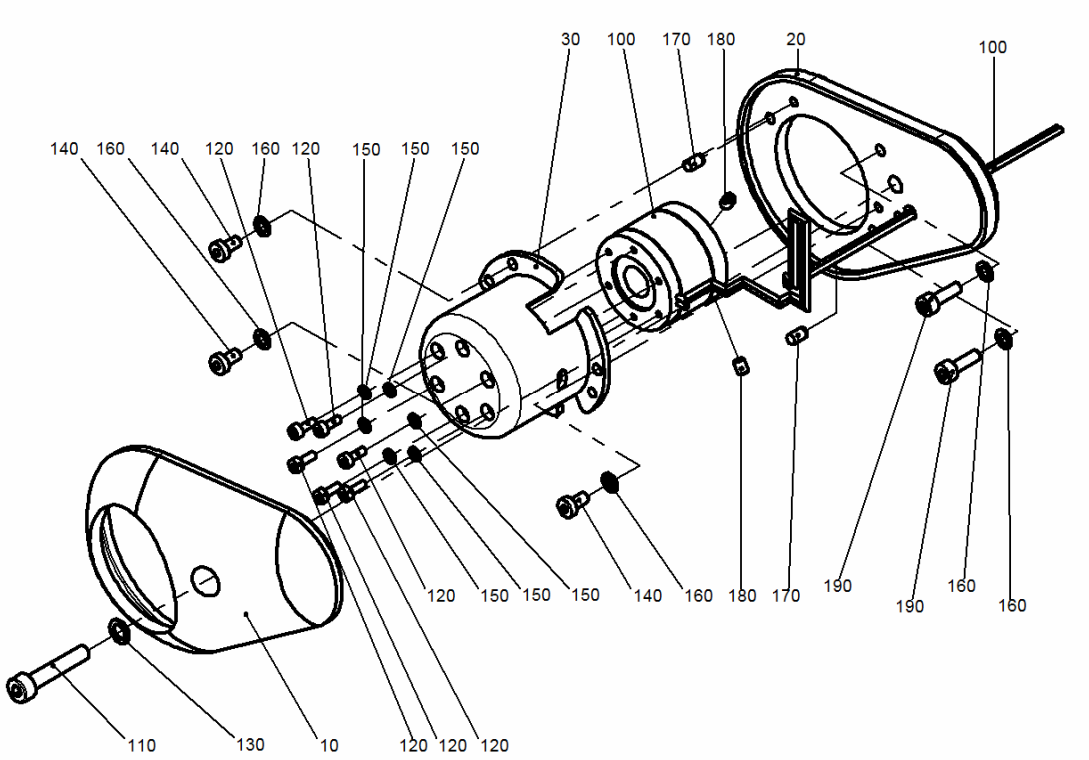
Item	Sym.	Designation	Ref. No.	Material
	◘	Electrical rotary unit DAE-60 complete	57835	
10	◊	Housing	57509	Al
20	◊	Cover, one-part	57510	Al
30	◊	Housing, gear	57507	Al
40	◊	Cover, gear, coated	57587	Al
50	●	Motor with toothed disk	57475	Diverse
60	◊	Flange, bottom	57317	Al
70	◊	Guide	57382	Steel
90	◊	Output shaft	57319	Steel
100	◊	Flange, internal	57312	Al
120	◊	Crown wheel z130	57504	Steel
130	◊	Encoder terminal group	57085	Diverse
150	◊	Motor + sensor terminal group	57281	Diverse
160	◊	Clamping piece for proximity switch	47906	Steel
170	◊	Clamping screw for 47906	47904	Steel
180	◊	Toothed disk GT 2MR 80S	57611	Al
190	◊	Flange for clamping set 7x10x4 5	57508	Steel
200	◊	Shaft, gear	57304	Steel
210	◊	Gear ring	57506	Al
220	◊	Nameplate CE	41620	Polyester
230	◊	Nameplate cover	48508	Polyester
300	◊	Cylinder head screw hex socket M4x12 vz BN3	502506	Steel
310	◊	Circlip, shaft 8x0.8 sw BN818	502446	Steel
320	◊	Deep-groove ball bearing 1r 8x22x7 608.2RSR	520117	Steel
330	◊	Circlip, bore 22x1 sw BN822	520286	Steel
340	◊	Cylinder head screw hex socket M8x8 sw BN1206	520267	Steel
350	◊	Ribbed washer M4x7x0 5 vz BN792	502606	Steel
360	◊	Cylinder head screw hex socket M4x18 vz BN3	508473	Steel
370	◊	Cable lug fork M3 0.5-1 insulated	520345	Diverse
380	◊	Ribbed washer M3x5 5x0.45 sw BN791	502363	Steel
390	◊	Cylinder head screw hex socket M3x6 sw BN272	501602	Steel
400	●	Toothed belt GT 2MR 208x9	520357	Polyurethane
410	◊	Protective stopper 4x6x4 PE black	520348	PE
420	◊	Cylinder head screw hex socket M4x14 vz BN3	508472	Steel
430	◊	Cylinder head screw hex socket M3x14 vz BN3	520057	Steel
440	◊	Cylinder head screw hex socket M3x20 vz BN3	520107	Steel
460	◊	Deep-groove ball bearing 1r 25x47x12 6005.2RSR	504916	Steel
470	◊	Shrink disk 24x21 M5x16 TLK603 half S	520327	Steel
480	◊	Deep-groove ball bearing 1r 20x37x9 6904.RS	508130	Steel
490	◊	Cable screw union M12x1 5 short	520197	Brass
500	◊	Cable PU 18x0 14mm2	520261	Diverse

510	◊	Cable PU 3x0.5mm2 screened	520260	Diverse
520	◊	Thread-grooving cheesehead screw M3x6 vz BN13916	506341	Steel
530	◊	Countersunk screw hex socket M4x35 vz BN21	520284	Steel
540	◊	Countersunk screw hex socket M4x12 vz BN21	506845	Steel
550	●	Inductive proximity switch PNP 6.5x22x2000	508842	Diverse
560	◊	Clamping set 7x10x4 5	520268	Steel
570	◊	Cable screw union M12x1 5 short	520406	Brass
	●	EC Motor Controller (ECMR)	57332	Diverse

● These are wearing parts and are available from stock
◊ Not available from stock individually (upon request)
◘ Price-listed items available from stock

5.1. Parts list for DAE-60 permanent magnet brake (option)

Exploded view



Item	Sym.	Designation	Ref. no	Material
	◘	DAE-60 permanent magnet brake (option)	57550	
10	◊	Cover, gear PM brake, coated	57547	Al
20	◊	Holder, permanent magnet brake	57548	Al
30	◊	Cover, permanent magnet brake	57549	Al
100	●	Permanent magnet brake 0.4 Nm	510017	Diverse
110	◊	Cylinder head screw hex socket M4x22 vz BN3	506183	Steel
120	◊	Cylinder head screw hex socket M2x6 vz BN11	520335	Steel
130	◊	Ribbed washer M4x7x0.5 vz BN792	502606	Steel
140	◊	Cylinder head screw hex socket nK M3x6 vz BN17	520040	Steel
150	◊	Ribbed washer M2x4x0.35 vz BN14083	520334	Steel
160	◊	Ribbed washer M3x5.5x0.45 sw BN791	502363	Steel
170	◊	Straight pin 3h6x6 bl hardened BN858	502018	Steel
180	◊	Setscrew hex socket cone M3x4 sw BN24	501884	Steel
190	◊	Cylinder head screw hex socket M3x10 vz BN3	502503	Steel

● These are wearing parts and are available from stock
◊ Not available from stock individually (upon request)
◘ Price-listed items available from stock

6. General information

6.1. Environmental compatibility and disposal

Materials used:
- Aluminum
- Steel
- Copper
- PU (polyurethane)
- Brass
- Polyester

Surface treatment:
- Anodization of aluminum
- Nickel-plating of brass
- Coating of aluminum

Shaping processes:
- Machining of aluminum and steel
- Aluminum casting

Emissions during operation:
None

Disposal:
Devices which cannot be used anymore should be recycled not as complete units but dismantled into components and disposed of according to the type of material. The type of material used for each part is shown in the spare parts lists. Material which cannot be recycled should be appropriately disposed of.

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